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PATENT SPECIFICATION

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COMPLETE SPECIFICATION

Improvements relating to Radar Testing Equipment

We, METROPOLITAN - VICKERS ELECTRICAL COMPANY LIMITED, of St. Paul's Corner, 1—3, St. Paul's Churchyard, London, E.C.4, a British Company, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to radar equipment and is concerned with apparatus for measuring the efficiency of such equipment. One method hitherto proposed for this purpose comprises a length of waveguide, closed at one end, and having the opposite end connected to an electromagnetic horn, or other elementary aerial arrangement and directed towards the radar equipment so as to act as an echo device for testing the radar equipment.

In such a scheme, however, the attenuation of conventional forms of waveguide limit the length of duration of response that can be obtained, and the waveguide is expensive and occupies considerable space.

The object of the present invention is to provide an improved arrangement whereby these disadvantages are largely overcome.

The present invention comprises an echo device for use with radar equipment for the purpose of testing and comprising a length of surface wave transmission line, together with a reflecting device at one end, and a collecting and launching device at the other end, which latter device is coupled to an aerial for receiving waves from the radar set and re-transmitting echoes thereto.

The term "surface wave transmission line" is used to denote a single conductive wire with the surface treated in such manner as to retard the velocity of propagation of an electromagnetic wave along the surface of the wire. Such a surface treatment may comprise the cutting of circumferential grooves in the wire, or preferably by coating the wire with a thin layer of low-loss dielectric. By means of a launching device, such for example as a concentric line, the outer conductor of which is flared out into a cone at one end, or a waveguide having a flared end, an electromagnetic wave of suitable frequency may be propagated along and in the immediate vicinity of such a wire. For any given type of launching device, there is a minimum frequency for efficient working; any frequency above this minimum is included here under the term "suitable." Energy can be transmitted along such a wire with very low loss.

The reflecting device may comprise a plate located at right angles to the wire and suitably dimensioned to reflect substantially the whole of the field.

The method of operation of the device according to the present invention is as follows: Electromagnetic energy from the radar transmitter is picked up by the collecting device, which may be a dipole aerial with or without reflectors or reflecting surfaces, or any other suitable form of collector, and said energy is transmitted to the launching device, which launches the surface wave along the transmission line. At the far end of this line the reflecting plate reflects back most of the energy, which is then collected by the launching device and re-radiated by the aerial, the echo being picked up by the radar receiver, so as to give a response on the screen of the radar presentation unit, at a range corresponding to the delay introduced by the go-and-return path along the transmission line, and the delay can be predetermined by appropriate choice of the length of

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the transmission line.

In the preferred arrangement the launching device is partly reflective so that only part of the energy is re-radiated, the remaining energy being reflected down the transmission line for a second trip. On its return part of the remaining energy is again re-radiated from the aerial to the radar receiver, and the remainder reflected back for a third trip, and so on, until the remaining energy is too small to give a response on the receiver. Thus a number of responses appear at the receiver, equally spaced and of decreasing amplitude, the number being a function of the overall performance of the radar equipment and of the attenuation of the surface wave transmission line and its terminal accessories, and the spacing being a function of the length of the line. Since the attenuation of the line can be accurately deduced, this therefore provides a means of determining the efficiency of the radar equipment.

In an embodiment of the invention particularly adapted for merchant ship radar, the surface wire transmission line takes the form of a wire, treated as described above, stretched between a mast or masts and a post or suitable portion of the ship's superstructure, near the radar aerial.

In order that the invention may be more clearly understood reference will now be made to the accompanying drawing in which Figs. 1 and 2 show two examples of apparatus embodying the invention.

Referring first to Fig. 1, the reference 1 indicates a waveguide section which is flared at 2 to form an aerial for receiving waves from the radar equipment under test and for retransmitting echoes.

The surface wave transmission line is indicated by the reference 3 and the left end of this projects into the waveguide at 4 so as to provide a coupling. Around the left end of the line 3 is an outer concentric conductor 5; this in effect constitutes the outer conductor of a short length of concentric line and is flared at 6 to form a wave launching and collecting device.

At the further end of the line 3 is a transverse plate 7 which constitutes the reflecting device.

In operation, the apparatus would be set up a short distance from the radar equipment and the aerial 2 would be directed toward the radar aerial. Waves picked up by the aerial 2 would be transmitted along the waveguide 1 and at 4 would be transferred to the surface wave transmission line 3. The flare 6 would launch these waves along the line to the further end where they would be reflected by 7, the echoes would be picked up by the device 6, whence they would be transferred to the aerial 2 and retransmitted back to the radar aerial.

If the coupling at 4 is mismatched, some of the power returned from 7 will be re-reflected, to give the multiple responses.

Fig. 2 shows a modification in which concentric line 5' through which the line 3 passes is directly connected to a dipole 8 placed in front of a reflector 9, the dipole 8 and reflector 9 replacing the aerial 2. The device 6' is partly coned to launch the wave along the surface wave transmission line, and partly plane to reflect part of the wave returning from 7, to give the multiple reflections as described above.

What we claim is:—

1. Apparatus for testing radar equipment comprising a length of surface wave transmission line having a reflecting device at one end and a launching and collecting device at the other end, which latter device is provided with means adapted for receiving waves from a radar set under test and for retransmitting echoes thereto.

2. Apparatus as claimed in claim 1, in which the launching device is made partly reflective, so as to give multiple echoes.

3. Apparatus as claimed in claim 1, or claim 2, in which the reflecting device comprises a metal plate extending transversely of the transmission line.

4. Apparatus as claimed in any preceding claim, in which the launching and collecting device comprises an outer conductor around the end of the transmission line and flared in the direction of propagation.

5. Radar equipment provided with testing equipment as claimed in any preceding claim, permanently installed with the radar equipment.

6. Testing apparatus for radar equipment arranged substantially as herein described with reference to Fig. 1 of the accompanying drawing.

7. Testing apparatus for radar equipment arranged substantially as herein described with reference to Fig. 2 of the accompanying drawing.

8. Radar equipment having testing equipment as claimed in claim 6 or claim 7, permanently installed and adapted to operate as herein described.

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PROVISIONAL SPECIFICATION

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We, METROPOLITAN-VICKERS ELECTRICAL COMPANY LIMITED, of St. Paul's Corner, 1—3, St. Paul's Churchyard, London, E.C.4, a British Company, do hereby declare this invention to be described in the following statement:—

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In such a scheme, however, the attenuation of conventional forms of waveguide limit the length of duration of response that can be obtained, and the waveguide is expensive and occupies considerable space.

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The reflecting device may comprise a plate located at right angles to the wire and suitably dimensioned to reflect substantially the whole of the field.

The method of operation of the device according to the present invention is as follows: Electromagnetic energy from the radar transmitter is picked up by the collecting device, which may be a dipole aerial with or without reflecting surfaces, or any other suitable form of collector, and said energy is transmitted to the launching device, which launches the surface wave along the transmission line. At the far end of this line the reflecting plate reflects back most of the energy, which is then collected by the launching device and re-radiated by the aerial, the echo being picked up by the radar receiver, so as to give a response on the screen of the radar presentation unit, at a range corresponding to the delay introduced by the go-and-return path along the transmission line, and the delay can be predetermined by appropriate choice of the length of the transmission line.

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In an embodiment of the invention

particularly adapted for merchant ship radar, the surface wire transmission line takes the form of a wire, treated as described above, stretched between a mast or masts and post or suitable portion of the ship's superstructure, near the radar aerial.

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1 SHEET

This drawing is a reproduction of the Original on a reduced scale.

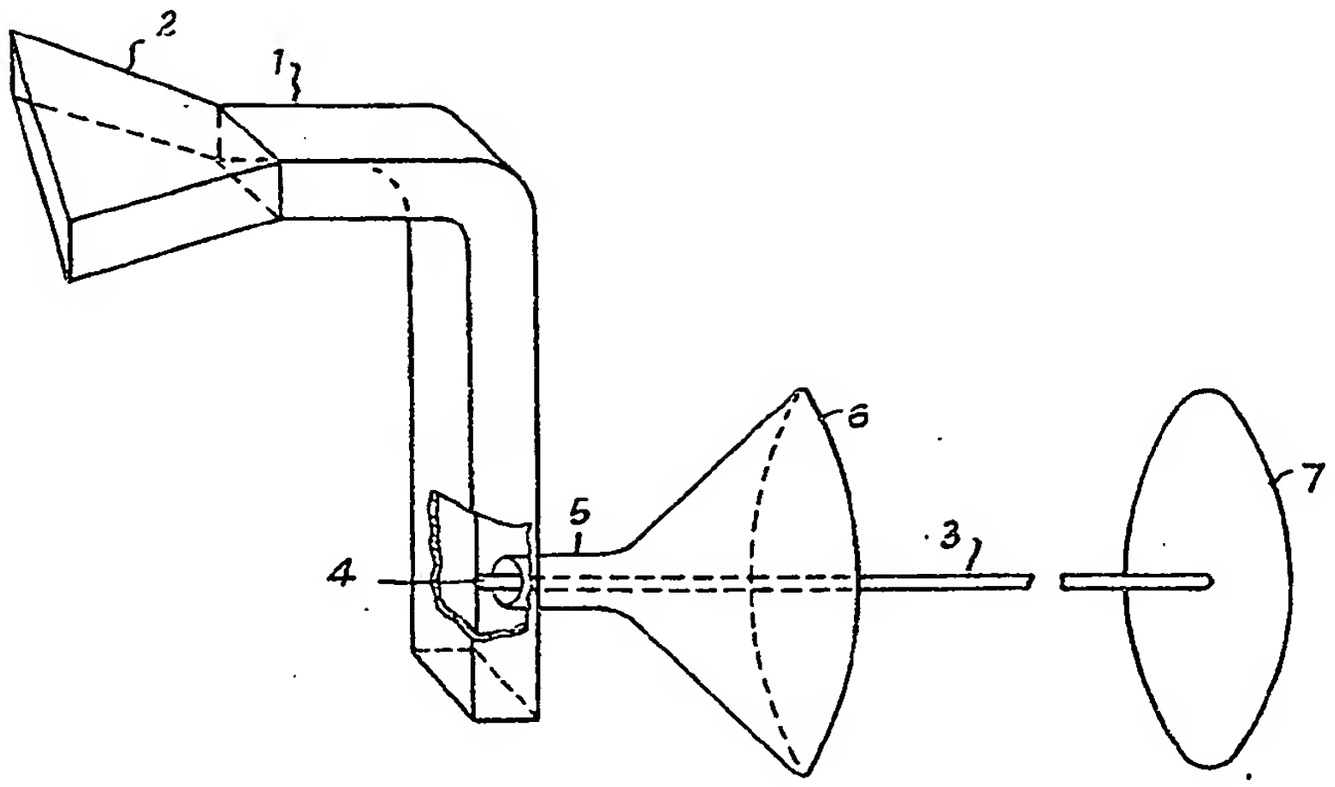

FIG.1.

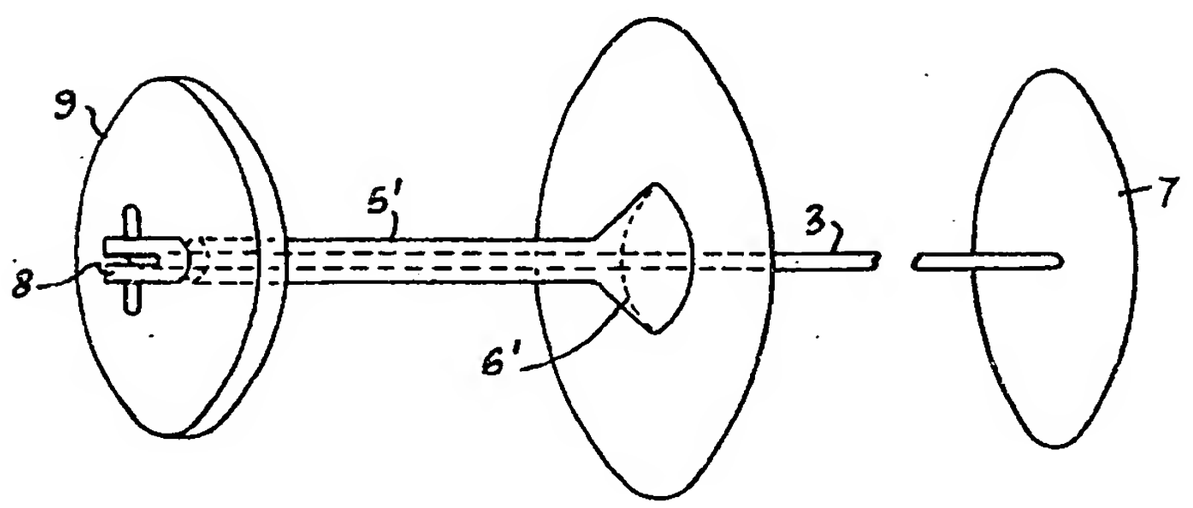

FIG.2.